DISTRIBUTION OF COASTAL VEGETATION IN KAPOPOSANG MARINE RECREATIONAL PARK SOUTH SULAWESI

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INTRODUCTION

Five to thirteen meters high tsunami on December 26th, 2004 demolished Aceh and Western Sumatran coast, made devastating and severe effects. More than 220.000 people were listed dead and missing and more than 400.000 people homeless. At least 120.000 ha terrestrial environment consist of fish farms, rice fields, plantation and villages has been damaged or inundated by seawater (Shofiyati *et al*., 2005).

Since this tsunami disaster, studies about coastal vegetation in Indonesia increased rapidly and have been conducted intensively. Role of coastal vegetation as defence against ocean sturges was more understood (Dahdouh-Guebas *et al*., 2005). Many people believe that the conversion of mangrove land into shrimp farms, tourist resort, agricultural or urban land over the past decade as well as destruction of coral reefs off the coast, have likely contributed significantly to the catastrophic loss of human lives and settlements during the recent tsunami event as mentioned above. From post-tsunami observation, it clear that mangroves have critical role in storm protection with the subtle point that these all depends the quality of the mangrove forest. Other type of coastal vegetation such as : saltmarshes, seashores sand dunes and beach forest also can contribute to protect against ocean surges (Dahdouh-Guebas, *et al*., 2005).

Coastal vegetation mostly occur in intertidal or coastal area and strongly influenced by surrounding environments. Therefore, plants in this littoral area must be adapted to salt spray, wind and wave action, and be able to recover from catastrophic disturbances. The conditions on sandy beaches due to the effects of drainage of these porous substrates may be even more limiting (Keppel, 2002). These communities also experience a wide array of adverse environmental conditions, such as high and low temperatures, high salinity and lack of nutrients. Thus, diversity, productivity and structural complexity are lower in these

communities (Scarano, 2002). Nevertheless, the communities were able to trap leaves and other organic material thrown by waves or winds when high tide and will increase nutrient availability through decomposition process. Coastal vegetation also has deep root that stabilize the coast from erosion (Whitten *et al*, 1987).

Spermonde Archipelago is a well-documented carbonate coastal shelf, located just off the coast near the city of Makassar, South Sulawesi. Extensive marine biological and physical geographic studies have been made in this area, which make it one of the best-explored regions in Indonesia (Moll, 1984; Hoeksema, 1990). However, information about distribution of coastal vegetation has poorly known (Whitten *et al*., 1987).

Most of the islands in Spermonde Archipelago have dense population. Terrestrial area of the island has been cleared off from vegetation for anchoring/mooring the boat, settlement, fish farm and small coconut plantation except the cemetery area. Local communities carry out small scale logging of the natural vegetation for building materials and firewood. Erosion and abrasion have been reported from this area (MCRMP, 2006). Lack of coastal vegetation made small islands was prone to the strong wave. In spite of the tidal range throughout the year rarely exceed 1-m (Hutchinson, 1945), the strong wave always occurs in the outer part of Spermonde Archipelago especially in Kapoposang Marine Recreational Park in the east moonson (MCRMP, 2006).

In this study, five islands were surveyed (Table 1) to estimate similarity of coastal vegetation species among the islands, investigate the distribution, dispersal types and factors affecting the composition of coastal species. Types of coastal vegetation that found in the fieldwork and anthropogenic impact were also discussed.

Table 1. Profile of islands in Kapoposang Marine Recreational Park.

Island	Island Size (Ha)	Number of Native Species	Number of Introduced Species	Elevation (m)	Population
Kapoposang	42.05	52	40	0 - 2	Rare
Papandangan	6.69	15	27	0 - 2	Dense
Gondongbali	5.28	34	43	0 - 2	Dense
Suranti	2.01	19	2	0 - 2	Uninhabited
Pamanggangan	1.74	18	2	0 - 1	Uninhabited
Total	57.77	59	62	-	-

Source: COREMAP 2006.

MATERIALS AND METHODS

Study Site

Kapoposang Marine Recreational Park was located in the outermost part of Spermonde Archipelago. It was established based on Forestry Minister Decree No. 588/Kpts-II/1996 on September 12th, 1996, as a conservation area (recreational park) to protect one of the best coral reef ecosystems that still exist in western part of South Sulawesi. The area covered more than 50.000 ha with five main islands: Kapoposang, Papandangan, Gondongbali, Pamanggangang and Suranti (Table 1; Figure 1).

Methods

Inventory of coastal vegetation species was conducted using cruise method or free sampling method. The aim of this research was to know the distribution of coastal species that grow along the beach and inner part of the island. Data were also collected from seaward to the inner terrestrial zone in several points to see the type of vegetation (zonation) of the coastal plants. Data and samples were collected using cruise/free sampling (survey) method by walking around the coastal of the island and cruising inside of the island.

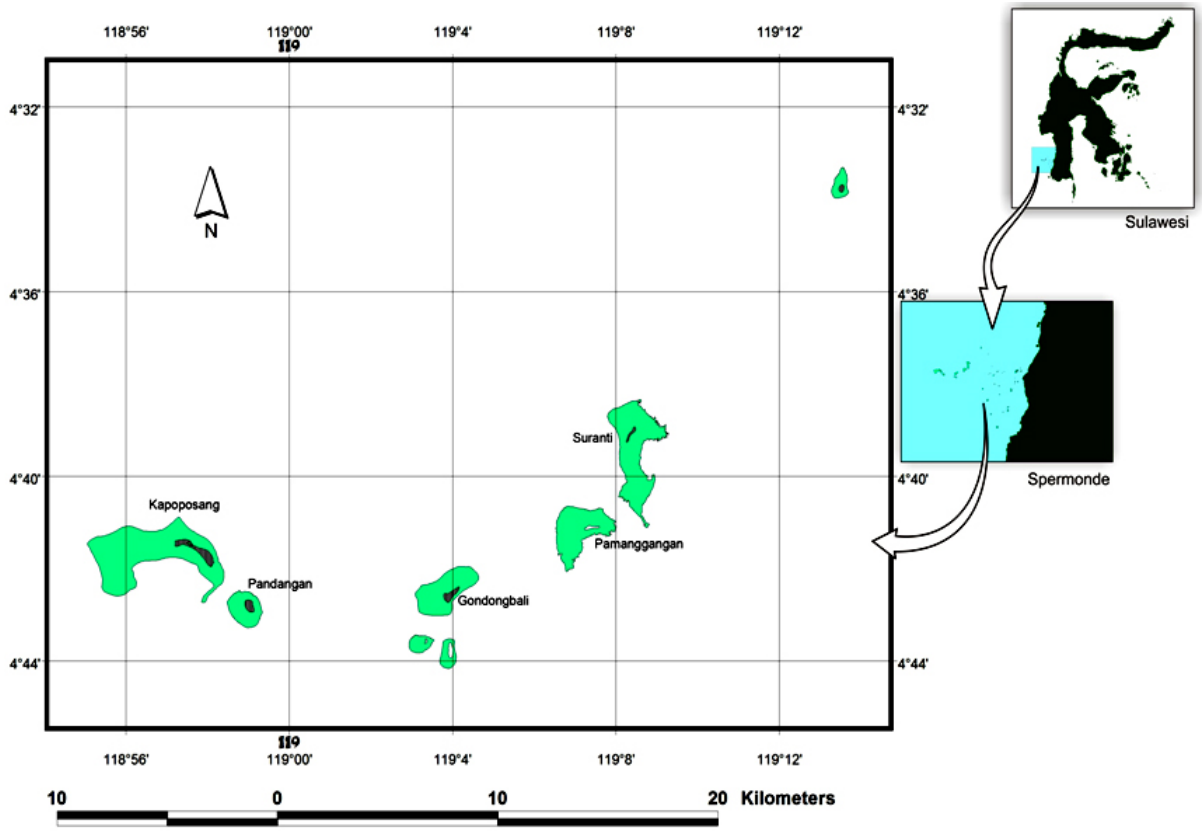

Figure 1. Map of study site.

In this research, the coastal plants categorised into the native and introduced species. Native species was defined as plants that their seeds were dispersed/distributed naturally on the island by ocean, wind and animals (e.g. bats or birds), while introduced species was plants that were cultivated or planted by settlers then become naturally in the field. Thus, data were analysed using cluster analysis (Bray-Curtis similarity) with Primer 3.1 software packages (2003) to compare the distribution of terrestrial vegetation from each island. Modes of dispersal for all species such as : oceanic, animal (birds and bats), or wind from each island were also recorded based on Smith (1990).

RESULTS AND DISCUSSION

Based on the survey conducted with free sampling method, data related to distribution of coastal vegetation, percentage of native and introduced species, similarity index, modes of dispersal and relation between coastal vegetation and area of the island have been recorded. Totally, 121 of coastal species were found in 5 islands in Kapoposang Marine Recreational Park. The highest number of species was recorded in Kapoposang Island-the largest island in the study area (figure 3), which the number of species was 92 or 75,21% from total species that recorded in 5 islands (figure 2 & 3), followed by Gondongbali by 77 species (61,98%), Papandangan with 42 species (34,71%), and Suranti with 20 species (17,36%).

The lowest number of species was recorded in Pamanggangan Island, the smallest island and was just inhabited by only less than 10 people, which was only have 20 species or 16,53% from the total species. (figure 2 & 3). Scarano (2002), notes that coastal vegetation in uninhabited or undisturbed islands originally consist of low diversity.

In contrast to the mentioned above, percentage of native species are higher in smaller islands than larger islands. Composition of native species in Suranti and Pamanggangan island were up to 90 % while in Papandangan and Gondongbali were only 35,7% and 44%, respectively (figure 4).

Many people believe that the number of native species will increase following the area of the island. However, the facts were recorded from the survey showed that the number of species were not following this pattern (figure 5). Papandangan is the second largest island in Kapoposang Marine Recreational Park. However, the native species in this island is lowest (15 species) compared to smaller islands such as: Gondongbali (34 species), Suranti (19 species) and Pamanggangan (18 species).

From these results, it is know that many factors affected the distribution of coastal vegetation species. Anthropogenic impact (human activities) likely contribute as the most influencing factor that determine the composition of coastal vegetation in the study area. Papandangan is the densest island and also consist of rocks more than other islands. Consequently, human and environmental pressures were increased and reduced the native species. More tolerance to environmental condition are also needed by introduced species to life in this island. Results of data analysis were showed below :

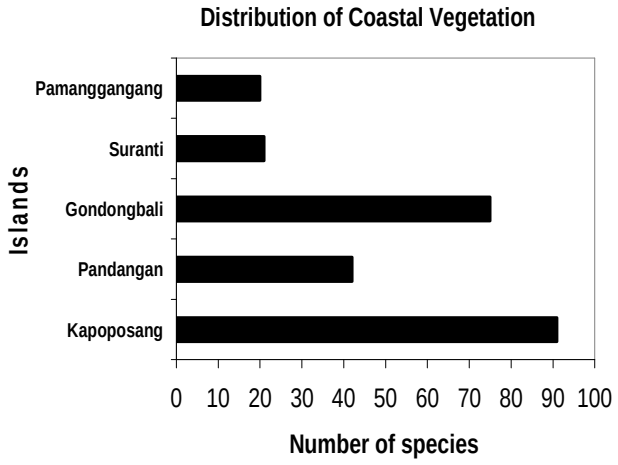

Figure 2. Distribution of coastal vegetation on each island (n=121)

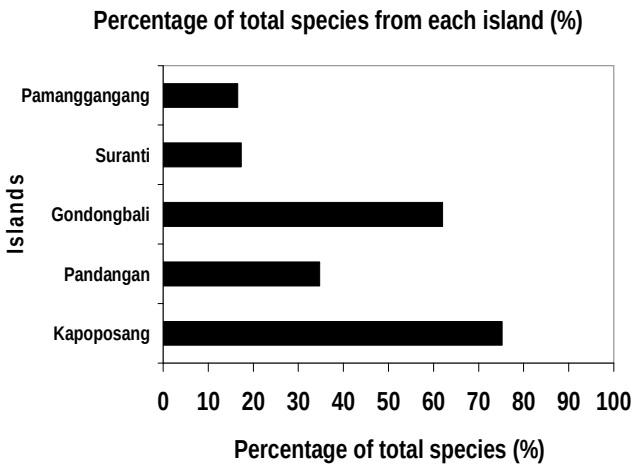

Figure 3. Percentage of total species on each island (n=121)

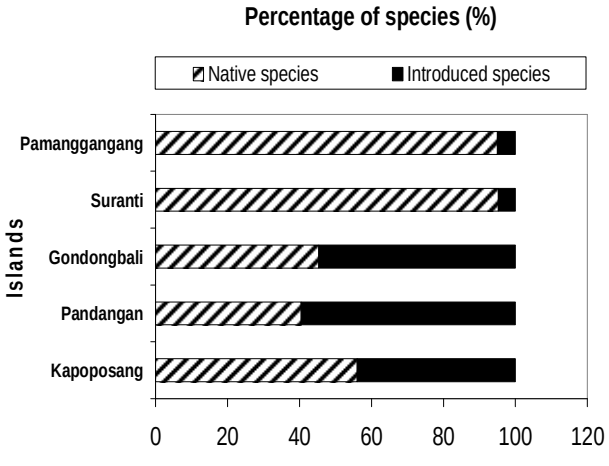

Figure 4. Percentage of native and introduced vegetation species on each island

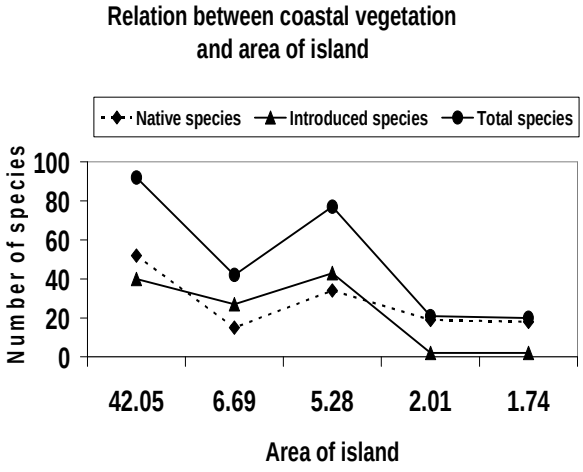

Figure 5. Relation between coastal and area of island

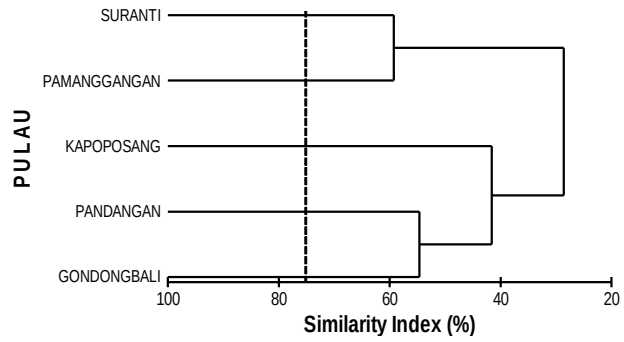

Figure 6. Similarity index of coastal vegetation on each island

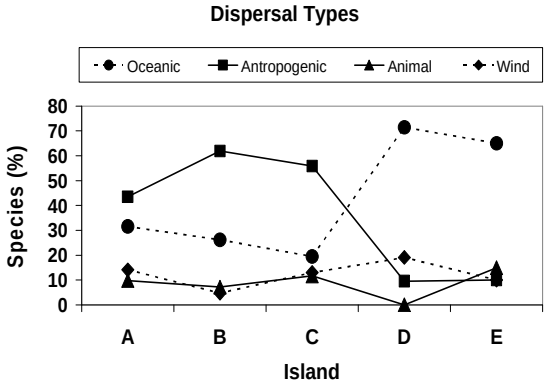

Figure 7. Modes of Dispersal
A= Kapoposang, B = Papandangan
C= Gondong Bali, D= Suranti
E= Pamanggangan

Composition of coastal vegetation species in Kapoposang Marine Recreational Park was different among islands. From similarity index graph in figure 6, it is showed that all islands are divided into 3 groups. Pamanggangan and Suranti, are uninhabited island that placed in one group. This showed that the composition of coastal vegetation in both islands were similar compared to other islands (figure 4). Papandangan and Gondongbali, are densely populated islands also have similar species composition (figure 4). Therefore, both islands were placed in the same group (figure 6).

Kapoposang as one group was closer to Papandangan and Gondongbali islands than Suranti and Pamanggangan islands (figure 6). So that, all of these islands have similar species composition. However, similarity index showed that none islands have truly similar species composition (figure 6). Brower *et al*. (1989) noted that two communities have the same species composition if their similarity index attain to at least 75%.

Oceanic and anthropogenic are the main modes of dispersal (the way of how seeds of coastal vegetation were distributed through the vectors) in Kapoposang Marine Recretional Park. Oceanic modes mostly occur in uninhabited islands such as; Suranti and Pamanggangan and anthropogenic modes mostly found in populated island (figure 7). Ghazanfar *et al*. (2001) reported that most of the species that occur on more than half of the small islands in Fiji are dispersed by ocean currents.

In this study, the number of coastal species in inhabited island increased between 43% to 64% from total number of species in each island (figure 4). Most of the species that introduced by human into the islands, consist of ornamental plants for garden that put in front of the house or for living fence and also plants that produce food or kitchen spice i.e bread fruit, banana, papaya, mango, guava, citrus lemon, lemon grass, chilly and tomatoes

(Appendix 1). Coconut was the only plant that cultivated in small scale plantation and can be found in all study sites. Coconut was also the most dominant and distributed species in all islands especially in Kapoposang, Gondongbali and Suranti islands.

The vegetation found in the study sites can be classified into three zone: sandy beach vegetation, mix shrub tree and mix littoral forest. The first zone above hightide level consists of creepers and grasses. The most common creepers was *Ipomoea pes-caprae* followed by *Canavalia maritima, Portulaca oleracea* and *Vigna marina.* The common grasses in this zone consist of: *Lepturus repens* and *Spinifex littoreus.*

Mixed shrub tree follows the herbaceous zone. *Scaevola taccada, Tournefortia argentea, Ximenia americana, Pandanus tectorius, Amarilis* sp and parasitic plant species *Cassitha filiformis* were common species. *Pemphis acidula* (locally known as santigi) was found dominated this zone in Kapoposang island, forming pure community consist of only one single species that grow in vast area and protect the beach from strong sturges and hightide.

The inner zone is littoral mix forest were dominated by tree and shrub such as : *Guettarda speciosa, Pongamia pinnata, Morinda citrifolia, Casuarina equisetifolia, Lantana camara, Leucaena leucochepala, Sizygium cumini, Wedelia biflora, Chromolaena odoratum, Cocos nucifera, Callophylum inophyllum, Zyzyphus mauritiana* and *Psidium guajava.*

Two species, *Sizygium cumini* and *Leucaena leucochepala* were recorded as the most dominant shrub species in littoral mix forest especially in Kapoposang Island where these species formed dense strand communities under coconut tree.

CONCLUSION

It can be concluded that distribution and species composition in all islands were different. Antropogenic impact (human activities) is the most influencing factor that affect the distribution and composition of coastal vegetation in all islands. A comprehensive study of coastal vegetation is recommended to know the details of the distribution of coastal vegetation and its community structure especially in Kapoposang Island. A detailed analysis vegetation using line or belt transect from seaward to inner island direction is required to know the profiles, life forms, types of vegetation and zonation that occur in this island.

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